

3C66B as a TeV radio-galaxy

Fabrizio Tavecchio^{*} and Gabriele Ghisellini

INAF/Osservatorio Astronomico di Brera, via E. Bianchi 46, I–23807 Merate, Italy

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ABSTRACT

The MAGIC collaboration reported the detection of a new VHE source, MAGIC J0223+430, located close to the position of the blazar 3C66A, considered a candidate TeV blazar since a long time. A careful analysis showed that the events with energies above 150 GeV are centered on the position of the FRI radiogalaxy 3C66B (at 6 arcmin from 3C66A), with a probability of 95.4% (85.4% including systematic uncertainties) that the source is not related to 3C66A. We present a model for the possible emission of 3C66B based on the structured jet model already used to interpret the TeV emission of the radiogalaxy M87. The model requires parameters similar to those used for M87 but a larger luminosity for the layer, to account for the more luminous TeV emission. We also show that the spectrum obtained by MAGIC can be interpreted as the combined emission of 3C66B, dominating above ~ 200 GeV, and of 3C66A. The high-energy emission from the latter source, being strongly attenuated by the interaction with the extragalactic background light, can only contribute at low energies. If we were to see the jet emission of 3C 66B at small viewing angles we would see a spectral energy distribution closely resembling the one of S5 0716+714, a typical blazar.

Key words: galaxies: active – galaxies: individual: 3C66B – BL Lacertae objects: individual: 3C66A – BL Lacertae objects: individual: 0716+714 – radiation mechanisms: non-thermal.

1 INTRODUCTION

Blazars represent the great majority of extragalactic objects detected in the very high energy (VHE, $E > 30$ GeV) γ -ray band (Aharonian et al. 2008, De Angelis, Mansutti & Persic 2008 for recent reviews)¹. Until now only one non-blazar source, the nearby (16 Mpc) FRI radiogalaxy M87 is an established VHE source (Aharonian et al. 2003, 2006a, Acciari et al. 2008, Albert et al. 2008a). Due to the limited spatial resolution of Cherenkov telescopes it is not possible to identify the TeV emission region of M87. However, the detection of variability on short timescales (\sim days, Aharonian et al. 2006a, Albert et al. 2008a) suggests a compact emission region, possibly related to knot HST-1 (e.g. Cheung, Harris & Stawarz 2007), to the black hole horizon (Neronov & Aharonian 2007) or to the innermost regions of the relativistic jet considered for blazars (Georganopoulos, Perlman & Kazanas 2005, Lenain et al. 2008, Tavecchio & Ghisellini 2008, hereafter TG08).

Recently, the MAGIC collaboration (Aliu et al. 2008) reported the detection, during observations taking place between August and December 2007, of a new source, MAGIC J0223+430, located close to the position of the BL Lac object 3C66A. This blazar (with probable redshift $z = 0.444$, Miller et al. 1978, but see Finke et al. 2008) has been considered a TeV candidate since a long time (Neshpor et al. 1998, Stepanyan et al. 2002) and it has been recently detected by VERITAS (with a soft spectrum, Swordy et al.

2008). However, a careful analysis of the MAGIC data shows that the events with energies above ~ 150 GeV are rather centered on the position of the near (6 arcmin) FRI radiogalaxy 3C66B (located at 85.5 Mpc), with a probability of 95.4% (decreasing to 85.4% if systematic uncertainties on the positioning are taken into account) that MAGIC J0223+430 is not related to 3C66A. The association with 3C66B is also indirectly supported by the relatively hard measured spectrum (photon index $\Gamma = 3.1 \pm 0.3$), difficult to reconcile with the expected strong absorption of VHE photons, through interaction with the extragalactic background light, for a source at the redshift of 3C66A. However, contamination from 3C66A (especially at low γ -ray energies) cannot be completely excluded. If the association of the excess with 3C66B will be confirmed, this would be the second known TeV emitting radiogalaxy, indicating that M87 is not an exceptional case.

In this letter we assume that the VHE emission detected by MAGIC comes from 3C66B and propose (Section 2) that it is produced, as in the case of M87, in the misaligned inner structured jet (Ghisellini, Tavecchio & Chianterghe 2005, hereafter GTC05, TG08). For “structured jet” we mean a jet composed by a fast internal spine surrounded by a slower layer. Both the spine and the layer emit and there is a strong radiative interplay between the two, since one component sees the radiation emitted by the other relativistically boosted by the relative velocity. In aligned sources (i.e. blazars) we preferentially see the radiation produced by the spine. Instead, for misaligned sources, as radiogalaxies, we tend to see the radiation produced by the layer, since its lower bulk Lorentz factor implies that its radiation is collimated within a larger solid angle.

^{*} E-mail: fabrizio.tavecchio@brera.inaf.it

¹ see also <http://www.mppmu.mpg.de/~rwagner/sources>

As in the case of M87, we show that, if observed under a small viewing angle, the SED of 3C66B would resemble that of a typical BL Lac object, S5 0716+714, also recently detected in TeV band by MAGIC (Teshima et al. 2008). In Section 3 we discuss the possible contribution of the (strongly attenuated) TeV emission of 3C66A to the observed MAGIC spectrum. Hereafter we assume the following cosmological parameters: $H_0 = 70 \text{ km s}^{-1} \text{ Mpc}^{-1}$, $\Omega_\Lambda = 0.7$, $\Omega_M = 0.3$.

2 VHE EMISSION OF 3C66B FROM A MISALIGNED STRUCTURED JET

2.1 The model

The spectral energy distribution (SED) of the core of 3C66B is shown in Fig.1. We use the equivalent isotropic luminosities L_ν , calculated from the corresponding fluxes F_ν with $\nu_\tau L_{\nu_\tau} = 4\pi d_L^2 \nu_o F_{\nu_o}$ (where d_L is the luminosity distance) and the frequency ν_τ is in the rest frame of the source, related to the observed one by $\nu_\tau = (1+z)\nu_o$. The TeV spectrum (red open squares) is taken from Aliu et al. (2008) and it has been corrected (blue open squares) for the (small) attenuation using the LowSFR model of Kneiske et al. (2004) which predicts a low level of the extragalactic background light close to what is presently inferred from observations (e.g. Franceschini et al. 2008) and indirect arguments (Aharonian et al. 2006b, Mazin & Raue 2007, Albert et al. 2008b).

In the X-rays this radiogalaxy shows a rather peculiar behaviour, with the spectrum apparently changing from soft to very hard (Trussoni et al. 2003, Balmaverde, Capetti & Grandi 2006, Evans et al. 2006). In particular, comparing *Chandra* and *ROSAT* observations, Trussoni et al. (2003) concluded that there are hints that the X-ray flux from the core of the source decreased by a factor ~ 4 in 10 years with an important softening of the spectrum. This behaviour, unusual for a radiogalaxy, is reminiscent of that of blazars and could support the idea that the emission comes from the misaligned jet. However, note that, due to the complexity of the observed X-ray spectrum, requiring several spectral components, a strong conclusion is not possible. Optical-UV data for the core have been obtained with the Hubble Space Telescope (Chiaberge, Celotti & Capetti 1999).

There is large consensus that the radio, the optical-UV and, possibly, the X-ray emission from the core of FRI radiogalaxies is due to synchrotron emission from the inner jet (Chiaberge et al. 1999, 2002, Hardcastle & Worrall 2000, Verdoes Kleijn et al. 2002, Balmaverde et al. 2006). For 3C66B a direct possibility could therefore be that the VHE emission is part of the high-energy inverse Compton component from the same regions of the jet. However, as detailed in TG08, a single-zone emission model fails in reproducing a SED with two emission peaks highly separated in frequency: 3C66B, in fact, has the first peak in the IR and the second peak probably close to TeV energies. The structured jet model, instead, allows to correctly reproduce the emission with parameters similar to those commonly inferred for blazar jets.

We model the SED using the structured jet model of GTC05 and applied to M87 in TG08. Briefly, we assume that the jet has a inner fast core (spine), with bulk Lorentz factor Γ_S , surrounded by a slower layer, with bulk Lorentz factor Γ_L . In both regions, relativistic electrons emit through synchrotron and inverse Compton mechanisms. The existence of a velocity structure impacts on the observed emission properties of the jet. Specifically, the radiative interplay between the layer and the spine amplifies the inverse

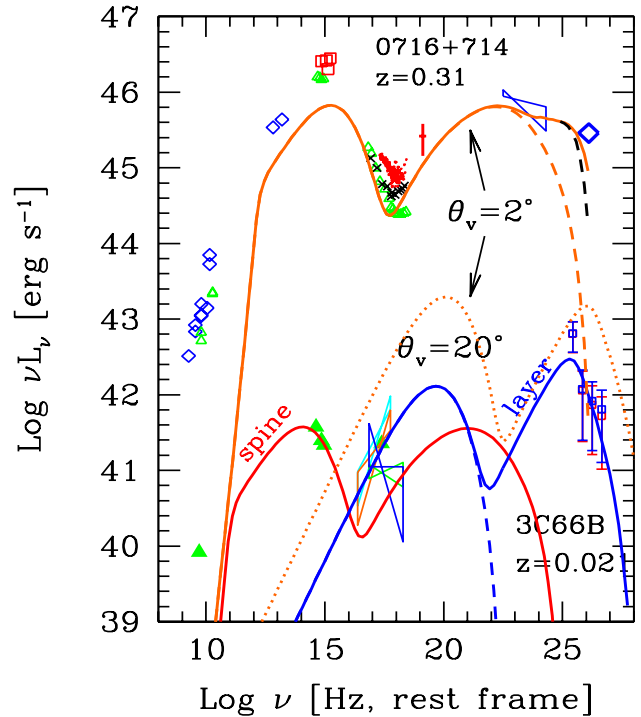


Figure 1. SED of the core of 3C66B (lower part), represented with the equivalent isotropic luminosity as a function of the rest frame frequency. Radio through UV data (green filled triangles) are from Trussoni et al. (2003) and references therein. X-ray data (bow-ties) are from Trussoni et al. (2003) (cyan and orange), Balmaverde et al. (2006) (blue) and Evans et al. (2006) (green). MAGIC data (red open squares) have been corrected for absorption (blue open squares) with the LowSFR model of Kneiske et al. (2004). The curves correspond to the structured jet model, considering the spine (red) and the layer (blue) emission. We also report (upper part) the emission seen by an observer almost aligned with the jet axis ($\theta_v = 2^\circ$) with (solid) and without (dashed) the contribution of the seed photons of the layer for the scattering by electrons in the spine. For comparison we also report historical data (taken from NED, Tagliaferri et al. 2003, Foschini et al. 2006, Hartman et al. 1999) describing the SED of the BL Lac S5 0716+714. The blue open diamond indicates the TeV flux as detected by MAGIC (Teshima et al. 2008). The black dashed line in the TeV region shows the γ -ray flux reaching the observer, considering the absorption through the interaction with the extragalactic background light estimated with the LowSFR model of Kneiske et al. (2004) assuming $z = 0.31$ for the redshift of S5 0716+714. The (negligible) emission from the layer at small angles is shown by the dotted line.

Compton emission of both components. Each component sees the emission of the other amplified because of the relative speed: this external radiation contributes to the total energy density, enhancing the emitted inverse Compton radiation. Depending on the parameters, this “external Compton” (EC) emission can dominate over the internal synchrotron self-Compton (SSC) component that, especially in TeV blazars, is depressed because scatterings mainly occur in the Klein-Nishina (KN) regime. We refer the reader to GTC05 for a more detailed discussion of the treatment used to calculate the EC term.

The model is specified by the following parameters: *i*) the spine is assumed to be a cylinder of radius R , height H_S (as measured in the spine frame) and in motion with bulk Lorentz factor Γ_S ; *ii*) the layer is modeled as an hollow cylinder with internal radius R , external radius R_2 , height H_L (as measured in the frame

	R cm	H cm	L_{syn} erg s $^{-1}$	n_e^a cm $^{-3}$	B G	γ_{min}	γ_b	γ_{max}	n_1	n_2	Γ	θ_v deg.
3C66B spine	5×10^{15}	5×10^{15}	10^{41}	1.3×10^3	1.8	1	5×10^3	6×10^4	2	4	10	20
3C66B layer	5×10^{15}	2×10^{16}	10^{41}	1.4	0.8	1	3×10^6	2×10^7	1.7	3.2	3	20
M87 spine	7.5×10^{15}	3×10^{15}	5.2×10^{41}	140.8	1	600	5×10^3	1×10^8	2	3.7	12	18
M87 layer	7.5×10^{15}	6×10^{16}	4.0×10^{38}	2.04	0.2	1	6×10^6	1×10^9	2	3.7	4	18

Table 1. Input parameters of the models for the layer and the spine shown in Fig. 1. All quantities (except the bulk Lorentz factors Γ and the viewing angle θ_v) are measured in the rest frame of the emitting plasma. The external radius of the layer is fixed to the value $R_2 = 1.2 \times R$. For direct comparison, we also report the parameters used for M87 (high state, from TG08). a : density of the relativistic electrons. Note that this is not a direct input parameter, since it is determined by the assumed L_{syn} .

of the layer) and bulk Lorentz factor Γ_L . Each region contains tangled magnetic field with intensity B_S , B_L and it is filled by relativistic electrons assumed to follow a (purely phenomenological) smoothed broken power-law distribution extending from γ_{min} to γ_{max} and with indices n_1 , n_2 below and above the break at γ_b . The normalisation of this distribution is calculated assuming that the system produces an assumed (bolometric) synchrotron luminosity L_{syn} (as measured in the local frame), which is an input parameter of the model. As in GTC05 and TG08 we assume that $H_L > H_S$. As said above, the seed photons for the IC scattering are not only those produced locally in the spine (layer), but we also consider the photons produced in the layer (spine).

In Fig. 1 (lower part) we report the model reproducing the data assuming the emission from the spine (red), accounting for the data from the radio to the optical-UV bands, and the layer (blue), assumed to emit the VHE radiation. In view of the possible contribution of 3C66A to the observed MAGIC spectrum (see Sect.3), we assume that the emission from the layer of 3C66B lies (slightly) below the point at the lowest energy. Parameters for the spine and the layer are reported in Table 1. To produce TeV photons, electrons of the layer must have a high value of γ_b . Consequently, for typical values of the magnetic field intensity, the corresponding synchrotron emission peaks in the X-ray band, determining a hard X-ray spectrum. The SSC emission from the layer is negligible, since most of the scatterings happen deeply in the KN regime. Therefore the high-energy emission of the layer, accounting for the measured MAGIC spectrum, is dominated by the EC component. On the contrary, the EC emission from the spine does not contribute significantly to the emission (at the viewing angles considered here: see the discussion in Section 2.3) and the high-energy bump is dominated by the SSC process. Since the spine has to reproduce the optical-UV peak the corresponding value of γ_b is lower than what assumed for the layer.

With the adopted parameters and assuming 1 proton per relativistic electrons (see e.g. Celotti & Ghisellini 2008) the estimated energy flux is 4.5×10^{44} erg s $^{-1}$ for the spine (dominated by protons), and 2.5×10^{41} erg s $^{-1}$ for the layer (magnetically dominated). A value around few 10^{44} erg s $^{-1}$ is within the range of energy fluxes estimated for FRIs (e.g. Bicknell & Begelman 1996, Laing & Bridle 2002). The value of the energy flux for the spine, largely dominated by protons, depends on their number density, in turn related to γ_{min} . In our fit we used $\gamma_{\text{min}} = 50$. Smaller values of γ_{min} do not affect the shape of the SEDs and in principle could be acceptable, though the derived energy flux would larger. In the the spine the ratio of Poynting flux to particle energy flux is dominated (by a factor ~ 10) by particles (cold protons). The layer, instead, appears to be magnetically dominated, with the Poynting flux about ten times the particle energy flux. In the spine, relativistic

electrons and magnetic field are close to equipartition, while in the layer the magnetic energy density is about two orders of magnitude larger than the electron energy density.

2.2 3C66B and M87

It is interesting to compare the SED and the parameters of the model obtained for 3C66B with those of M87 (also reported in Table 1).

The shape of the SED of the core of both radiogalaxies in the radio and the optical-UV bands appears rather similar, with a peak in the IR region. Also the luminosities (between 10^{40} erg s $^{-1}$ and 10^{41} erg s $^{-1}$) are comparable. In the X-ray band, M87 displays a soft spectrum, close to that of 3C66B as measured by *Chandra*. However, for M87 there are no hints of variability, as in the case of 3C66B.

A remarkable difference, instead, concerns the importance of the VHE emission. While the luminosity of M87 and 3C66B in radio, optical and X-rays (assumed to be produced by the spine) is comparable, the VHE luminosity (from the layer) is very different: even if the flux emitted at 150 GeV is contaminated by 3C66A (see also below) the output at VHE of 3C66B is more than an order of magnitude larger than for M87. The difference in the luminosity at TeV energies translates in the different (comoving) luminosities for the layer L_{syn} used in our model: 10^{41} erg s $^{-1}$ for 3C66B and 10^{38} erg s $^{-1}$ for M87. In 3C66B the layer requires the same power output of the spine. All the other parameters are instead very similar. The value of γ_{max} , different between the two sources, is physically unimportant, as long as $\gamma_{\text{max}} \gg \gamma_b$. Of course, these values refer to the specific (probably high) level of the emission of 3C66B at the epoch of the observations of MAGIC. Lower luminosities in the TeV band are possible. Indeed, in our scenario important variations of the emission from the layer are required to reproduce the variations observed in the X-ray band.

2.3 Pairing 3C66B and S5 0716+714

One can wonder what would be the SED calculated by our model for an observer located at a small viewing angle. Since we ought to obtain a SED similar to the SED of known blazars, this should be considered as a consistency check for our model and for the derived parameters. In Fig. 1 we report the predicted SED for a viewing angle of 2 degrees and compare it to the multi-frequency observations of the BL Lac S5 0716+714 at the redshift $z = 0.31$ (Witzel et al. 1988; but possibly larger, Sbarufatti, Treves & Falomo 2005). This blazar has been recently detected in the TeV band by MAGIC (Teshima et al. 2008). Although we do not pretend that

the model exactly reproduces the data, one can see that the two are rather similar. As discussed in TG08, the condition that the SED at small angles resembles those of known blazars dictates the choice that the VHE radiation comes from the layer.

At small angles, the emission is entirely dominated by the spine, which is characterised by a larger Lorentz factor. The direct emission from the layer (dotted line) provides a negligible contribution to the total observed emission. An important point to note is the rather hard spectrum predicted in the GeV band. The emission in this spectral band is mainly due to the EC component of the spine Comptonizing the seed photons provided by the layer. For comparison, the SSC component of the spine is reported by the dashed orange line. As already noted, the EC component from the spine is not prominent at larger angles (note the different shape of the high energy component of the spine for $\theta_v = 20$ deg). The reason is that, contrary to the case of the layer, the EC beaming cone of the spine is narrower than the corresponding synchrotron and SSC cones, an effect originally pointed out by Dermer (1995) in discussing the external inverse Compton emission in blazars. This effect is due to the fact that the seed photons produced in the layer are seen, in the spine frame, as coming from the forward direction. The pattern of the scattered radiation, even in the spine frame, is therefore *anisotropic*: more power is produced in directions close to the jet axis. When transforming in the observer frame, this translates into a radiation pattern that is more enhanced along the velocity (and jet axis) direction than the one usually derived when dealing with radiation that is isotropic in the comoving frame (see Fig.2 of TG08 that illustrates this point).

The presence of the layer is thus important even when the source is observed at small viewing angles and the entire radiation is provided by the spine. It enhances the observed radiation produced by the spine at high energies (GeV band), just where the suppression of the SSC flux due to KN effects starts to be important. The contribution of the seed photons of the layer is important when the layer luminosity is large, as in the case of 3C66B. This is the reason why, in the case of M87 paired with BL Lac, it was not noticeable: the layer luminosity, in that case, was much smaller.

3 THE VHE SPECTRA OF 3C66A/B

We cannot exclude that the nearby 3C66A contributes to the total emission measured by MAGIC, also in view of the recent detection by VERITAS (Swordy et al. 2008). However, due to the (uncertain) high redshift of this blazar, a sizeable contribution to the measured spectrum is expected only at the lowest energies, ~ 100 GeV.

The SEDs of 3C66A and B are compared in Fig. 2. For 3C66A we used historical data (see figure caption for references), together with the *R*-band flux averaged over the period of observation of MAGIC (Aliu et al. 2008). Unfortunately there are no observations in the GeV band of 3C66A around the epoch of the MAGIC observations. Therefore, in our model we assume the average spectrum (bow-tie) reported in the 3rd EGRET catalogue (Hartman et al. 1999).

We quantify the possible contribution of 3C66A to the spectrum measured by MAGIC modeling the SED, with the model for blazars described in Celotti & Ghisellini (2008)². To compare the

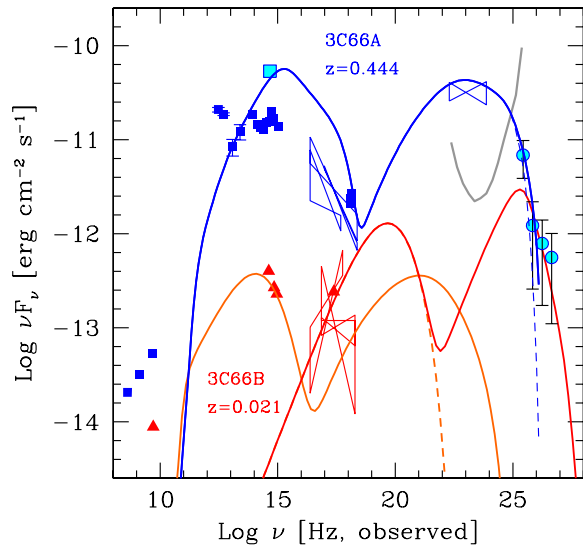


Figure 2. SED of 3C66B as in Fig. 1 and of 3C66A. Data for 3C66A (blue squares and bow-ties) are from NED (radio, optical), Impey & Neugebauer (1988) (IRAS), Donato et al. (2001) (ROSAT), Donato et al. (2005) (BeppoSAX), Foschini et al. (2006) (XMM-Newton), Hartman et al. (1999) (EGRET). The square in cyan reports the average optical (*R*-band) flux during the observations of MAGIC. The SED of 3C66A has been reproduced with the model for the blazar emission described in Celotti & Ghisellini (2008). The solid line is the spectrum emitted at the source, while the dashed line reports the γ -ray emission reaching the Earth after being absorbed by the interaction with the extragalactic background light (we assumed the LowSFR model of Kneiske et al. 2004 and a redshift of $z = 0.444$). The measured VHE spectrum of MAGIC (cyan circles) is reproduced as the sum of the emission from both sources, 3C66A being dominant below 200 GeV, and 3C66B accounting for the emission above 200 GeV. The grey line reports the *Fermi* sensitivity (for 1 year and 5σ significance).

data with the model, the curve of the intrinsic emission (solid line) has been absorbed with the LowSFR model of Kneiske et al. (2004) (dashed line). Due to the severe absorption, the flux from 3C66A above 100 GeV is strongly depressed and only 3C66B contributes to the observed spectrum. However, 3C66A could entirely account for the flux measured at the lowest energies. In this case, the contribution of 3C66A alleviates the requirement on the luminosity of the layer of 3C66B by a factor of 3 (as already noted the line for our model of 3C66B stays below the first bin of the MAGIC spectrum).

Of course, since no simultaneous data (especially at high energy) are available for 3C66A, our model of the SED is somewhat arbitrary. In particular, despite the strong absorption, a detectable emission in the TeV band is expected in states of high activity of the source. In fact, the recent detection by VERITAS, with a flux above 10^{-11} erg cm $^{-2}$ s $^{-1}$ (Swordy et al. 2008), has been obtained during a period of rather intense γ -ray activity, detected by *Fermi* (Tosti et al. 2008).

4 DISCUSSION

The possible detection of VHE photons from the FRI radiogalaxy 3C66B (at a distance of 85.5 Mpc) suggests that M87 is not an isolated case but, instead, radiogalaxies could represent a new class of extragalactic TeV sources. The fact that radiogalaxies can be relatively luminous γ -ray sources was proposed by GTC05 based on the idea of the existence of structured jets. According to this

² We use the following parameters: $R = 1.5 \times 10^{16}$ cm, $\Delta R = R$, $L' = 3.8 \times 10^{42}$ erg s $^{-1}$, $B = 1.4$ G, $\gamma_{\min} = 1$, $\gamma_b = 4.5 \times 10^3$, $\gamma_{\max} = 10^5$, $n_2 = 3.6$, $\Gamma = 18$, $\theta_v = 3$ deg. See Celotti and Ghisellini (2008) for a full description of these parameters.

scenario, in sources with misaligned jets, the emission from the fast regions of the jet is deboosted while the slower layer can still provide an important contribution because of the broader emission cone.

The best VHE candidates are the radiogalaxies in which the jet axis lies at a relatively small angle with respect to the line of sight. M87, with an angle between 30 and 20 degrees is probably one of the best cases. For 3C66B we assume in our model a similar angle, 20 degrees. For larger angles the deboosting becomes more important and thus the power requirement grows substantially. The consequent increase of the intrinsic luminosity of the spine in the optical-IR band results in a large optical depth for the pair production process for VHE photons within the layer. Radio VLBI observations (Giovannini et al. 2001) show a complex structure for 3C66B, with the possible presence of a counter-jet at small distances, disappearing at larger distances. Giovannini et al. (2001) interpreted this behavior as the evidence that the jet accelerates, from $\beta = 0.6$ at 1.5 mas (linear deprojected distance of about 1 parsec) to $\beta = 0.99$ at 4.5 mas from the core and a jet inclination of about 45 degrees. However, this interpretation is not unique, the same effect being produced by a jet with constant speed, $\beta = 0.83$, varying the angle (of both the jet and the counter-jet) from $\theta = 60$ deg to $\theta = 30$ deg. Moreover, this conclusion is based on the implicit assumption that the jets are exactly symmetric. Local variations of the emissivity in one of the two jets could easily mimic such a phenomenology. Given these uncertainties we consider that $\theta = 20$ degrees for the inner jet (at distances of 0.1 pc) is possible.

As extensively discussed in TG08, the model parameters are not completely constrained by the data. A whole family of solutions is allowed. However, the requirement that the parameters of the spine, and its SED at small angles, are similar to those of blazars allows us to partly constrain the parameters.

In our model we implicitly assume that the region emitting γ -rays from 3C66B is, as for M87, the inner jet. However, since no variations have been detected, the alternative models invoking emission from more distant regions along the jet (e.g. Stawarz, Sikora & Ostrowski 2003) cannot be excluded. Further observations are needed to clarify this point.

An important point to note is the important contribution of the EC component to the spine emission at small angles. The contribution is particular relevant above the GeV band, determining a hard spectrum up to the VHE band. In the previous model for M87 this component was not so prominent due to the lower intrinsic luminosity required for the layer. In BL Lacs this component could play an important role in determining the high-energy γ -ray spectrum. In particular, since SSC dominates below and the EC above the GeV band, variability of the layer emission could determine different variability of the emission in the two bands. Simultaneous observations with *Fermi* and Cherenkov telescopes could test this possibility.

Another important point to mention is that, due to its limited angular resolution, *Fermi* cannot distinguish between the two sources, 3C66A and B. However, the MeV-GeV band should be largely dominated by 3C66A, with a rather small contribution from the radiogalaxy only at the largest energies covered by *Fermi*. Above 100 GeV, however, the situation reverses, and thus the emission can be dominated by 3C66B when 3C66A is at low level. In these occasions, Cherenkov telescopes, characterized by a good angular resolution, could possibly simultaneously detect both sources.

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